Electrical Resistivity and Superstructure of CuAu_3

Electrical Resistivity and Superstructure of $CuAu_3$*

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Abstract

The superlattice formation in the alloy $CuAu_3$ containing 75.0_6 atomic per cent gold was studied by measurements of electrical resistivity and by means of X-ray diffraction with a single crystal. After the alloy was quenched from 450°C, the isothermal change in resistivity was measured at various temperatures between 100°C and 220°C. In most of the isothermal measurements, the resistivity increased monotonously with the time of annealing, possessing an activation energy of 25 ± 2Kcal/mol. It was found, however, that after prolonged annealing at 162 and 175°C sluggish decrease in resistivity took place following initial increase. The transition point of this alloy was determined as 200 ± 5°C.

Corresponding to the resistivity measurement, X-ray diffraction patterns were taken at various states of ordering at 100°C, 150°C and 180°C as well as at the states quenched from 210°C and 450°C. It was confirmed that nucleation and growth of small anti-phase domains in the disordered lattice take place in accordance with the rise in resistivity, and that the development of order within the domains plays an important role in the reduction of resistivity. Then even after three months anneaing at 180° and 100°C, the ordered alloy $CuAu_3$ has a two-dimensional, rather than one-dimentional, anti-phase domain superstructure with the linear dimension of nearly 11 times the fundamental face-centered cubic cells. In every stage examined, the main lattice reflections were surrounded by fairly strong diffuse scatterings, which is considered to be caused by the thermal motion of atoms, not by the lattice distortion due to ordering. Finally, comparing with the alloy Cu_3Au, the change in resistivity due to ordering was discussed in connection with the result of X-ray study.

On the Superstructure of the Ordered Alloy Cu_3Pd. III. High Temperature Electron Diffraction Study**

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Abstract

Using a high temperature electron diffraction camera, Cu_3Pd alloys have been investigated in thin oriented, evaporated films at temperatures below and above

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